Developing new learning materials and strategies for improving CHEM 1151 course

This proposal addresses the following areas of concern in CHEM 1151, Survey of Chemistry I:

1. A need for a proper strategic plan to teach non-science major students
2. A need for instructional materials supporting cooperative learning settings for both traditional and non-traditional students
3. A need for course materials that will encourage active student engagement

In the CHEM 1151 course, we approach basic concepts of chemistry with a focus on the application of chemical theory to health science. This course is offered in higher numbers than other chemistry courses as more and more students are interested in serving their community and becoming a health professional. The course is a pre-requisite for first semester Anatomy & Physiology, BIOL 1611, which is the first stepping stone towards any professional degree in health science. Upon successful completion of this course, students should have a firm understanding of the chemical behavior of biological substances and the direct applications of chemistry in various fields of the medicinal, forensic and pharmaceutical industries. At GPC, this course has been offered in different formats including traditional face to face, hybrid, and online. Also, the online homework program MasteringChemistry has been used to enhance student learning.

Objective: In this study we will examine if there is a relationship between the nature of the course delivery and student achievement. We’ll look at the students’ performance in technology-based classes and compare with traditional format classrooms where the usage of technology is minimized by oral instruction and whiteboard presentation. We will evaluate the online homework program and its effectiveness as a learning tool in all three formats of this course. We will attempt to understand the difference in effectiveness between the web based and traditional content delivery systems by comparing student success rates and by comparing personal preferences from student evaluations.

As a quantitative measure, we will conduct statistical tests (analysis of variance) on the students’ grades data among different methods of teaching. As a qualitative measure of students’ evaluation, a survey will be conducted at the end of the semester for each course and students’ feedback will be collected to study further.

History of the problem and other people’s work: Most colleges and universities offer online courses (Martin, 2012; Norma I. Scagnoli, Vol 13(2)) and thus help distant students to complete their course requirements online. There has been a significant amount of work to study the effect of offering non-chemistry courses online or in a hybrid format instead of the traditional face to face format (Pratt, 2010). Web based tutorial materials for basic chemistry as well as for higher level chemistry courses are growing day by day. Chemistry educators are using these online resources to teach their face to face courses. We have been considering the issue for some time, and in this study, we’ll try to determine the difference in effectiveness between an online presentation and a face to face presentation for the first semester survey chemistry course at GPC.
In fall’12 there were total 1200 students took this course and the passing rate was 65.2% (ABCs) overall not reaching the top quarter of the total student population. The failure rate was also not negligible with 12.1% and this indicates a need to improve the learning materials and strategies to improve the course.

Activity Plan: Classroom students are the main participants of this research study. Researchers may not exclude student participants on the basis of gender, race, national origin, religion or socioeconomic status. An announcement will be made in class to inform the students about the study; also, extra points will be offered to encourage the students to participate in the project. Any information about individual students’ grades or names will not be disclosed in connection with this research by any of the co-PIs or the student assistant. Four sections of the same course will be considered under this research study.

1. 1st section will be taught in pure traditional way: oral delivery of the material and use of white board to teach the course content. This section will be taught by Co-PI Dr. Burkart.
2. 2nd section will be taught using visual medium on some of the important topics from the course. The teaching videos will be made by the co-PI Dr. Blum.
3. 3rd section will include the use of iclickers to teach along with lecture materials. iclickers will be used to get the instant anonymous response of the students in class. The use of iclickers signifies students’ attention span during the lecture and level of preparation in class. Data collected from the grades using the iclickers will be used to examine the correlation between the effect of additional technology used in class and student success rate. This course will be taught by PI Dr. Dutta.
4. 4th section will be taught online by Dr. Dutta.

Data will be collected for each test and homework assignment and also for short assessments like iclicker results or reading quizzes. Online course students will also take same assessments as face to face courses. Students’ retention, homework assignment grades, test grades, and final grades will be compared and statistically analyzed for all of the four sections. A student assistant will be hired to keep a record of the data. The student researcher will learn scientific research skills and will be able to analyze data and interpret statistical results after comparing data for all sections’ grade books. The same course was taught in hybrid format at GPC by PI Dr. Dutta and one of the co-PIs Dr. Blum. Success rates in hybrid courses compared to face to face courses for the short reading quizzes will also be compared and analyzed.

Personnel:

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Evaluation plan: Gradebook data will be used to evaluate student performance in different fields. Data will be collected for classes taught during the present academic year as well as for past years, and a comparison study will be developed to find the best format and strategic plan to teach this course. The following information will be extracted from the students’ grades:

1. Average grade on tests and quizzes for face to face, technology enhanced and online courses
2. Is there any relationship between graded homework and student achievement?
3. How does the student performance in online course compare with face to face?
4. How do the students feel about learning in their online and face to face classes?
5. Is technology neutral or enhancing student learning?

Dissemination Plan: The findings of this study will be presented at professional meetings and faculty development workshops. PI- Dr. Dutta and Co-PIs Dr. Blum and Dr. Burkart will be responsible for publishing the results. The results will be implemented in classroom teaching. Also, research findings will be shared among peer faculty members to implement new strategies for teaching the course. The student assistant will complete a questionnaire in the beginning and at the end of the project. The quality of the published work will be the indicator of the impact of this research project.

References:

- **Susan J. Martin**, “Final Comparison Study of Teaching Blended In-Class Courses vs. Teaching Distance Education Courses", Systematics, Cybernetics and Informatics, Vol10 No 6(2012),40.
- **Greg Pratt** “Hybrid Course Delivery in Microeconomics: A preliminary report based upon: Current research, practice and hybrid courses taught in ECN 112 Principles of Microeconomics” at Mesa Community College